

2-CHLOROACETOPHENONESynonym: **tear gas**

CASRN: 532-27-4

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Human Health Effects:**Human Toxicity Excerpts:**

SYMPTOMS INCL TEARING, BURNING OF THE EYES & DIFFICULTY IN BREATHING, BUT SELDOM ANY PERSISTENT OR PERMANENT DISABILITY. HIGH CONCEN MAY LEAD TO ... ACUTE PULMONARY EDEMA AFTER LATENCIES OF 8 HR TO SEVERAL DAYS. FIRST & PERHAPS SECOND DEGREE BURNS OF SKIN MAY OCCUR, PARTICULARLY IF IN CONTACT WITH ABRADED AREAS.

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. II-96]**PEER REVIEWED**

A PECULIAR, SHORT LIVED (45 MIN) RAPIDLY DEVELOPING TOLERANCE OCCURS TO /2-CHLOROACETOPHENONE/ WHEN EXPOSURE CONCEN ... HIGH TO CAUSE PROFUSE LACRIMATION & OTHER SIGNS OF IRRITATION; PERSISTENCE OF CYANIDE IN THE ATMOSPHERE LEADS TO CESSATION OF SYMPTOMS. CROSS TOLERANCE RAPIDLY DEVELOPS ALSO TO BROMBENZYL CYANIDE, CHLOROPICRIN, CHLOROCROTONALDEHYDE, ETHYL-CHLOROFORMATE AND TRICHLOROMETHYL FORMATE. ... TWO REPORTS SUGGEST THAT INDIVIDUALS CAN BE SENSITIZED TO ... /2-CHLOROACETOPHENONE/ WITH CROSS OVER REACTIONS WITH O-CHLOROBENZILIDINE MALONONITRILE. SENSITIZATION WAS MORE READILY PRODUCED & REACTIONS MORE SEVERE WITH ... /2-CHLOROACETOPHENONE/.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 264]**PEER REVIEWED**

... 12 PATIENTS ... SPRAYED IN THE EYES WITH CHEM MACE ... @ DISTANCE OF 6-12 INCHES ... HAD INJURIES OF EPITHELIUM OF CORNEA & CONJUNCTIVA DEMONSTRABLE BY STAINING WITH FLUORESCEIN ... 9/12 HEALED IN 72 HR. THE OTHER 3 HAD MORE EXTENSIVE EPITHELIAL INJURY WHICH TOOK 14-21 DAYS TO HEAL COMPLETELY ... IN 1 EYE A SUPERFICIAL STROMAL OPACITY ... /PERSISTED/ FOR 5 MO, BUT THIS WAS SUPERFICIAL AND LOCATED PERIPHERALLY IN THE CORNEA.

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 885]**PEER REVIEWED**

Skin reactions of sensitized guinea pigs to challenging doses of chloroacetophone included erythema, edema, induration, necrosis, and eschar formation.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 265]**PEER REVIEWED**

ACCIDENTAL OVEREXPOSURE OF EYES ... CAN RESULT IN PERMANENT PARTIAL OPACITY.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 264]**PEER REVIEWED**

Some prisoners sprayed with 2-chloroacetophenone during a disturbance at San Quentin Prison in April 1981 required hospitalization because of severe laryngotracheobronchitis, chemical skin burns, conjunctivitis, and apparent allergic reactions.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.14 Technical Report Series No.379 (1990) NIH Pub No.90 2834]**PEER REVIEWED**

Solid chloroacetophenone also caused significant damage to the cornea, iris, conjunctiva, and eyelids ...

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I, II, III. Cincinnati, OH: ACGIH, 1991. 277]**PEER REVIEWED**

The uses of tear gas, its toxicity, and treatment for exposure were reviewed. The two compounds most commonly used in recent years were identified as omega-chloroacetophenone (CN) and o-chlorobenzylidenemalononitrile (CS). Previous reports and reviews of tear gas usage and exposure effects were considered. The results of a survey of tear gas use in civil disturbances in Seoul, Korea were summarized. The agent used in these events was identified as CS; in exposed persons near exploding tear gas canisters, effects included penetration trauma, skin burns, and impaired lung function. The Korean medical community was not found to have access to information necessary for treating those who were exposed. A similar report of tear gas use in Gaza and the West Bank of Israel was cited. The development of CS as the predominant tear gas agent, and its use in riot control and in Vietnam was described, as was its toxicology. Inhalation studies showing an association between high level CS exposure and pneumonitis, pulmonary edema, heart failure, hepatic damage, and death were cited. The use of tear gas in enclosed spaces, or detonating gas grenades or canisters directly into crowded gatherings could result in exposures to much higher levels than use in the open. Studies of long term pulmonary and genotoxic effects were appraised as inconclusive, and the lack of reproductive epidemiologic studies was noted. CS was hypothesized to be genotoxic, due to its ability to alkylate sulfhydryl groups. The toxicity of CN was compared to CS. Treatment for CS and CN exposures was described, including skin washes, supportive pulmonary therapy, and observation. The authors conclude that there is a need for further investigations into the toxicological potential of tear gas chemicals.

[Hu H et al; J of the American Medical Association 262 (5): 660-3 (1989)]**PEER REVIEWED**

Human Toxicity Values:

A 10 MINUTE EXPOSURE TO 0.85 MG/L IS ESTIMATED TO BE LETHAL IN MAN.

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-96]**PEER REVIEWED**

Skin, Eye and Respiratory Irritations:

IRRITATION THRESHOLDS RANGE FROM 0.15-0.4 MG/CU M; LACRIMATION THRESHOLDS FROM 0.3-0.4 MG/CU M

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values, 4th ed., 1980. Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists, Inc., 1980. 83]**PEER REVIEWED**

Irritant to eyes in concentration of 0.3 ppm. ...

[ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1988. 117]**PEER REVIEWED**

... The substance is an irritant to the upper respiratory tract and the skin.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 264]**PEER REVIEWED**

Accidental overexposure of the eyes ... can result in permanent partial opacity (leukoma); under ordinary exposure ... the severe conjunctivitis, corneal haziness, and pain, ... are not permanent.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 265]**PEER REVIEWED**

Probable Routes of Human Exposure:

NIOSH (NOES Survey 1981-1983) has statistically estimated that 2,293 workers (1,411 of these are female) are potentially exposed to 2-chloroacetophenone in the US(1). Occupational exposure to 2-chloroacetophenone can occur at workplaces where 2-chloroacetophenone is produced or used through inhalation of dusts and vapors and through skin contact(2). The use of "Chemical Mace" to disable attackers causes direct exposure to 2-chloroacetophenone through eye and skin contact and inhalation (SRC).

[(1) NIOSH; National Occupational Exposure Survey (NOES) (1983) (2) Parmeggiani L; Encycl Occup Health & Safety 3rd ed. Geneva, Switzerland: International Labour Office p. 1170-3 (1983)]**PEER REVIEWED**

Emergency Medical Treatment:

Emergency Medical Treatment:

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The following Overview, *** LACRIMATORS ***, is relevant for this HSDB record chemical.

Life Support:

- o This overview assumes that basic life support measures have been instituted.

Clinical Effects:

SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

- o INITIAL SYMPTOMS - In threshold concentrations the lacrimators cause immediate ocular burning, blepharospasm, lacrimation, rhinorrhea, coughing, sneezing, and pain but usually no permanent tissue damage. In higher concentrations chemical burns with keratitis, loss of the corneal epithelium, and permanently reduced corneal sensation may be noted.
- o DELAYED SYMPTOMS - Initial symptoms may be followed by chest tightness and coughing, sore throat, shortness of breath, burning of the tongue and mouth, salivation, and vomiting. Burning sensation of the skin, followed by erythema and bullous dermatitis, may occur following

exposure to tear gas containing O-chlorobenzylidene malononitrile (CS) or mace containing 1-chloroacetophenone (CN).

- o DURATION - Symptoms usually subside rapidly within 15-30 minutes of cessation of exposure in most individuals. Ocular symptoms may persist if the eyes are rubbed. Painful contact dermatitis may persist for several hours following exposure to pepper mace (capsaicin).
- o MECHANICAL INJURIES - When the charge of tear gas is fired at close range, powder infiltration of the conjunctiva, cornea, and sclera will occur. The force may be sufficient to cause conjunctival tear(s). Fragments of the tear gas cartridge may perforate or penetrate the ocular structures.

HEENT

0.2.4.1 ACUTE EXPOSURE

- o Eye exposure may result in ocular burning, pain, blepharospasm, and lacrimation. These effects may last up to 30 minutes or longer. Permanent eye injury is unlikely except following eye exposure to high concentrations of mace containing 1-chloroacetophenone (CN).
- o Ocular redness and edema may be noted from 1 to 2 days following exposure to any of these agents.

CARDIOVASCULAR

0.2.5.1 ACUTE EXPOSURE

- o Tachycardia and mild hypertension may occur as a result of fear and pain. Congestive heart failure may occur in adults after exposure to high concentrations of O-chlorobenzylidene malononitrile (CS).

RESPIRATORY

0.2.6.1 ACUTE EXPOSURE

- o Cough, rhinorrhea, sneezing, chest tightness, and laryngospasm may occur shortly following exposure due to the irritant effects.
- o Pulmonary edema may occur up to 12 to 24 hours after exposure.
- o Bronchospasm and bronchopneumonia may occur immediately or as delayed effects.

NEUROLOGIC

0.2.7.1 ACUTE EXPOSURE

- o Agitation and syncope, both attributed to panic, have been reported.

GASTROINTESTINAL

0.2.8.1 ACUTE EXPOSURE

- o A metallic taste with a burning sensation of the tongue is common. Nausea is common; vomiting occurs occasionally. Epigastric discomfort and burping may occur if tear gas is swallowed.

HEPATIC

0.2.9.1 ACUTE EXPOSURE

- o Hepatocellular injury has been reported with serious CS gas intoxication.

GENITOURINARY

0.2.10.1 ACUTE EXPOSURE

- o Renal tubular injury has been reported.

DERMATOLOGIC

0.2.14.1 ACUTE EXPOSURE

- o Irritation may occur to all body surfaces where significant exposure has occurred. Painful contact dermatitis may persist for several hours following exposure to mace containing capsaicin. Bullous dermatitis may develop 12 to three days after exposure to tear gas containing O-chlorobenzylidene malononitrile (CS). Erythema, vesicle eruptions, and denuded areas with weeping tender erythematous base may develop one day after exposure to mace containing 1-chloroacetophenone (CN).

IMMUNOLOGIC

0.2.19.1 ACUTE EXPOSURE

- o Hypersensitivity reactions have been reported.

Laboratory:

- o Plasma levels of these agents are not useful.

Treatment Overview:

SUMMARY EXPOSURE

- o Brief or low concentration exposures usually respond rapidly to removal from the offending agent without treatment. High concentration exposures or prolonged exposures may produce serious respiratory symptoms including pulmonary edema and death.
- o Treatment is symptomatic and supportive. There is no specific antidote.

INHALATION EXPOSURE

- o DECONTAMINATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer 100 percent humidified supplemental oxygen with assisted ventilation as required.
- o EMERGENCY DEPARTMENT PERSONNEL should avoid contamination while handling and examining any patient with tear gas injuries by taking precautions that include wearing aprons, rubber gloves and masks as indicated.
- 1. The patient's clothing may contain residual particles from the exposure and clothing should be removed and stored in a sealed polythene bag to prevent degassing. If clothing is to be washed, cold water should be used because hot water will cause residual O-chlorobenzylidene malononitrile (CS) gas to vaporize.
- o INHALATION EXPOSURE: Evaluate respiratory function rapidly. Laryngospasm may require tracheal intubation and ventilation.

EYE EXPOSURE

- o DECONTAMINATION: Exposed eyes should be irrigated with copious amounts of tepid water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

DERMAL EXPOSURE

- o DECONTAMINATION: Wash exposed area extremely thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.
- o Remove all contaminated clothing while avoiding self-contamination. Meticulously wash all exposed areas with copious amounts of soap and water. The patient's

clothing may contain residual particles from the exposure and clothing should be removed and stored in a sealed polythene bag to prevent degassing. If clothing is to be washed, cold water should be used because hot water will cause residual O-chlorobenzylidene malononitrile (CS) gas to vaporize.

Range of Toxicity:

- o The minimum toxic or lethal dose is not well established in the literature.
- o The incapacitating concentration of chloroacetophenone, chlorobenzylidene malonitrile and chloropicrin is 5 to 20 mg/m(3), 2 to 5 mg/m(3) and 4 ppm, respectively.

[Rumack BH: POISINDEX(R) Information System. Micromedex, Inc., Englewood, CO, 2001; CCIS Volume 107, edition exp February, 2001. Hall AH & Rumack BH (Eds):TOMES(R) Information System. Micromedex, Inc., Englewood, CO, 2001; CCIS Volume 107, edition exp February, 2001.] **PEER REVIEWED**

Antidote and Emergency Treatment:

Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... For contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport ... Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal ...

./Ketones and related compounds/

[Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994. 237]**PEER REVIEWED**

Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest. Positive pressure ventilation techniques with a bag valve mask device may be beneficial. Monitor cardiac rhythm and treat arrhythmias if necessary ... Start an IV with D5W /SRP: "To keep open", minimal flow rate/. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of fluid overload. Consider drug therapy for pulmonary edema ... Use proparacaine hydrochloride to assist eye irrigation/Ketones and related compounds/

[Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994.,p. 237-8]**PEER REVIEWED**

Animal Toxicity Studies:

Non-Human Toxicity Excerpts:

AT HIGH CONCN ... PERMANENT OPACIFICATION, ULCERATION WITH VASCULARIZATION AND PERFORATIONS CAN BE PRODUCED IN THE EYES OF LAB ANIMALS. POSSIBLE SYSTEMIC MANIFESTATIONS INCL AGITATION, MIOSIS, COMA, AREFLEXIA AND FATTY INFILTRATION OF LIVER.

[Gosselin, R.E., H.C. Hodge, R.P. Smith, and M.N. Gleason. Clinical Toxicology of Commercial Products. 4th ed. Baltimore: Williams and Wilkins, 1976.,p. II-68]**PEER REVIEWED**

... LIQ RESIDUE @ ATMOSPHERIC PRESSURE OBTAINED FROM SPRAY CANS OF CHEM MACE ... DROPPED DIRECTLY ON THE EYES OF UNANESTHETIZED ANIMALS CAUSED

LOSS OF CORNEAL EPITHELIUM & CLOUDING OF THE STROMA, BUT THESE HEALED IN 3-10 DAYS. IF RABBITS WERE ANESTHETIZED BEFORE /APPLICATION/ THE REACTION WAS MUCH MORE SEVERE, CONSISTING OF GREATER STROMAL EDEMA, DEVELOPMENT OF CORNEAL OPACITY, IRIDOCYCLITIS, & HYPOPYON, WITH SERIOUS DEGENERATIVE CHANGES IN THE CORNEAS IN SOME ANIMALS.

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 884]**PEER REVIEWED**

THE TOXICITY OF ALPHA-CHLOROACETOPHENONE IN TEST ANIMALS IS DESCRIBED AND DATA ARE EXTRAPOLATED TO HUMANS. NO CARCINOGENICITY COULD BE FOUND, ALTHOUGH CMPD WAS EMBRYOTOXIC AND DID CAUSE ALLERGIC SENSITIZATION.

[ELSKAMP DM W; TOXIC PROPERTIES OF CN AND CS; REPORT (MBL-1976-14) (1976)]**PEER REVIEWED**

1-CHLOROACETOPHENONE CAUSED CONTACT SENSITIZATION OR DELAYED HYPERSENSITIVITY IN GUINEA PIGS BY TOPICAL OR INTRADERMAL ADMIN. IT IS MORE IRRITATING TO SKIN & MORE ALLERGENIC WHEN ADMIN AS MACE THAN IN ACETONE. INTRADERMAL ADMIN CAUSED ERYTHEMA, EDEMA, INDURATION, NECROSIS; DERMAL APPLICATION CAUSED THE SAME EFFECTS PLUS ESCHAR.

[CHUNG CW, GILES AL JR; J IMMUNOL 109 (2): 284 (1972)]**PEER REVIEWED**

RABBIT EYES DOSED WITH 1-CHLOROACETOPHENONE 1-10% IN POLYETHYLENE GLYCOL 300 SOLN SHOWED INFLAMMATION, CORNEAL DAMAGE (5-10% SOLN), KERATITIS, INCR IN CORNEAL THICKNESS & INTRAOCULAR TENSION. SOLID FORM: SIMILAR BUT MORE SEVERE EFFECTS. USING AEROSOL: CONJUNCTIVAL & LID IRRITATION.

[BALLANTYNE B ET AL; ARCH TOXICOL 34 (3): 183 (1975)]**PEER REVIEWED**

Chloroacetophenone was evaluated for mutagenicity in the Salmonella/microsome preincubation assay using the standard protocol approved by the National Toxicology Program. The chemical was tested at doses of 0, 0.3, 1, 3, 10, 33, 100, and 333 ug/plate in four Salmonella typhimurium strains (TA98, TA100, TA1535, and TA1537) in the presence and absence of Aroclor induced rat or hamster liver S9. Chloroacetophenone was negative in these tests and the highest ineffective dose level tested (not causing a complete clearing of the background lawn) in any Salmonella tester strain was 100 ug/plate.

[Zeiger E et al; Environ Mutagen 9: 1-110 (1987)]**PEER REVIEWED**

Incubation of chick embryos in the primitive streak stage with 0.5-3 mM 2-chloroacetophenone for 15-120 minutes increased the frequency of abnormalities in the nervous system, including improper differentiation and incomplete closure of the brain. Well differentiated closed neural tubes were observed in embryos incubated with 2-chloroacetophenone and subsequently exposed to sulfhydryl agents. Embryos incubated at the head process stage with 2-chloroacetophenone showed normal development. Thus, the inhibitory effect of 2-chloroacetophenone on morphogenesis of the nervous system in chick embryos was reversible.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.15 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

2-Chloroacetophenone ... increased incidence of epidermal papillomas in skin of mice previously given dermal applications of 0.3 ml of 0.15% 9,10-dimethyl-1,2-benzanthracene dissolved in acetone. Twenty-one days after exposure to 9,10-dimethyl-1,2-benzanthracene, mice received applications of 0.3 ml of 0.4%-0.8% 2-chloroacetophenone in acetone twice per week for 12 weeks and then once per week for

15 weeks. Twenty epidermal neoplasms were observed in 9/12 mice that received the 9,10-dimethyl-1,2-benzanthracene plus 2-chloroacetophenone applications, compared with 1 neoplasm in 12 control mice that received 9,10-dimethyl-1,2-benzanthracene followed by dermal applications of acetone on the same dosing schedule. Epidermal hyperplasia was also observed at the site of application of 2-chloroacetophenone.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.15 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

2-Chloroacetophenone toxicity may be due to the alkylation and consequent inhibition of sulfhydryl-containing enzymes because inhibition of lactate dehydrogenase activity by 2-chloroacetophenone in vitro was not reversed by glutathione and because intravenous administration of sodium thiosulfate did not protect rats from lethal doses of 2-chloroacetophenone given by intraperitoneal injection.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.14 Technical Report Series No.379 (1990) NIH Pub No.90 2834]**PEER REVIEWED**

2-Chloroacetophenone was not mutagenic in *Salmonella typhimurium* strains TA98, TA100, TA1535, or TA1537 with or without exogenous metabolic activation. In cytogenetic tests with CHO (Chinese hamster ovary) cells, 2-chloroacetophenone did not induce sister chromatid exchanges with or without activation, but a weak positive increase in chromosomal aberrations was observed in the absence of metabolic activation.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.4 Technical Report Series No. 379 (1990) NIH Pub No. 90-2834]**PEER REVIEWED**

The biochemical changes in blood samples of rats at different intervals after O-Chloracetophenone (CN) and Dibenz (b,f)-1,4 oxazepine (CR) were studied. After a single subacute (1/10 LC50) exposure, both the compounds induced hyperglycaemia which was abolished within 24 h. The level of plasma urea was unaltered. CR exposed animals did not show any significant changes in plasma GOT, acid and alkaline phosphatase activities at different intervals. However, in CN exposed animals, a significant elevation of the activities of GOT, GPT, acid and alkaline phosphatase was observed at different intervals. All the parameters became normal within seven days after the exposure. Inhalation of CN aerosols can thus lead to tissue damaging effects in rats.

[Husain K et al; Indian J Med Res Sect B 94 (FEB): 76-9 (1991)]**PEER REVIEWED**

National Toxicology Program Studies:

Carcinogenesis studies were conducted by exposing groups of F344/N rats and B6C3F1 mice of each sex to air containing 2-chloroacetophenone vapor for ... 2 years. ... Groups of 60 rats of each sex were exposed to a vapor of 0 (chamber control), 1 or 2 mg/cu m (0, 15, or 0.3 ppm) 2-chloroacetophenone, 6 hours per day, 5 days per week. Groups of 60 mice of each sex were exposed to 0 (chamber control), 2, or 4 mg/cu m (0, 3, or 0.6 ppm) on the same schedule. ... Fibroadenomas of the mammary gland occurred in female rats with positive trends, and the incidence in the 2 mg/cu m group was greater than that in chamber controls (control, 12/50; 1 mg/cu m, 19/50; 2 mg/cu m, 23/50). The incidences of adenomas or adenocarcinomas of the mammary gland were not increased in the exposed groups. Minimal to mild suppurative inflammation of the nasal mucosa was observed at increased incidences in exposed male rats. Hyperplasia and squamous metaplasia of the nasal respiratory epithelium were observed at increased incidences in exposed male and female rats. In mice, squamous metaplasia of the respiratory epithelium of the nasal passage was seen in four females and two males exposed to 4 mg/cu m 2-chloroacetophenone. Inflammation, ulcers, and squamous hyperplasia of the forestomach were observed at increased incidences in exposed female rats. There were no exposure related increased

incidences of neoplastic lesions in mice.

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.4 Technical Report Series No. 379 (1990) NIH Pub No. 90-2834]**PEER REVIEWED**

Non-Human Toxicity Values:

LD50 Rat oral 127 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Rabbit oral 118 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Guinea pig oral 158 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Mouse iv 81 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Rat ip 36 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Guinea pig iv 17 mg/kg

[DHHS/NTP; Toxicology and Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) p.13 Technical Report Series No.379 (1990) NIH Pub No.90-2834]**PEER REVIEWED**

LD50 Rat oral 1820 mg/kg

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 723]**PEER REVIEWED**

Metabolism/Pharmacokinetics:

Pharmacology:

Environmental Fate & Exposure:

Environmental Fate/Exposure Summary:

2-Chloroacetophenone's production and use as an intermediate in pharmaceuticals and as an ingredient in chemical MACE may result in its release to the environment through various waste streams. It may be directly released to the environment during its use as a riot control gas. If released to air, a vapor pressure of 5.4×10^{-3} mm Hg at 25 deg C indicates 2-chloroacetophenone will exist solely in the vapor-

phase in the ambient atmosphere. Vapor-phase 2-chloroacetophenone will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 8 days. The UV spectrum for a hexane solution of 2-chloroacetophenone shows absorbency maxima occurring at 291 and 329 nm which indicates that 2-chloroacetophenone may directly photolyze in the environment. If released to soil, 2-chloroacetophenone is expected to have high mobility based upon an estimated Koc of 90. Volatilization from moist soil surfaces is expected to be an important fate process based upon an estimated Henry's Law constant of 3.5×10^{-6} atm-cu m/mole. 2-Chloroacetophenone will not volatilize from dry soil surfaces based upon its vapor pressure. If released into water, 2-chloroacetophenone is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. Volatilization from water surfaces is expected to be an important fate process based upon this compound's estimated Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 14 and 110 days, respectively. An estimated BCF of 1 suggests the potential for bioconcentration in aquatic organisms is low. Hydrolysis is expected to occur very slowly; products are hydrochloric acid and hydroacetophenone. Occupational exposure to 2-chloroacetophenone may occur through dermal contact with this compound at workplaces where 2-chloroacetophenone is produced or used. The use of "Chemical Mace" to disable attackers causes direct exposure to 2-chloroacetophenone through eye and skin contact and inhalation. (SRC)

****PEER REVIEWED****

Probable Routes of Human Exposure:

NIOSH (NOES Survey 1981-1983) has statistically estimated that 2,293 workers (1,411 of these are female) are potentially exposed to 2-chloroacetophenone in the US(1). Occupational exposure to 2-chloroacetophenone can occur at workplaces where 2-chloroacetophenone is produced or used through inhalation of dusts and vapors and through skin contact(2). The use of "Chemical Mace" to disable attackers causes direct exposure to 2-chloroacetophenone through eye and skin contact and inhalation (SRC).

[(1) NIOSH; National Occupational Exposure Survey (NOES) (1983) (2) Parmeggiani L; Encyl Occup Health & Safety 3rd ed. Geneva, Switzerland: International Labour Office p. 1170-3 (1983)] ****PEER REVIEWED****

Artificial Pollution Sources:

2-Chloroacetophenone's production and use as an intermediate in pharmaceuticals(1) and as an ingredient in chemical MACE(2) may result in its release to the environment through various waste streams(SRC). It may be directly released to the environment during its use as a riot control gas(1).

[(1) Lewis RJ Sr, ed; Hawley's Condensed Chemical Dictionary. 13th ed. NY, NY: John Wiley and Sons, Inc. p. 251 (1997) (2) Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)] ****PEER REVIEWED****

Environmental Fate:

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of 90(SRC), determined from a structure estimation method(2), indicates that 2-chloroacetophenone is expected to have high mobility in soil(SRC). Volatilization of 2-chloroacetophenone from moist soil surfaces is expected to be an important fate process(SRC) given an estimated Henry's Law constant of 3.5×10^{-6} atm-cu m/mole(SRC), determined using a fragment constant estimation method(3). 2-Chloroacetophenone undergoes hydrolysis very slowly; products are hydrochloric acid and hydroacetophenone(5). 2-Chloroacetophenone is not expected to volatilize from dry soil surfaces(SRC) based upon a vapor pressure of 5.4×10^{-3} mm Hg(4). Insufficient data are available to predict the importance of biodegradation or other degradation processes in soil(SRC).

[(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Meylan WM et al; Environ Sci Technol 26: 1560-67 (1992) (3) Meylan WM, Howard PH; Environ Toxicol Chem 10: 1283-93 (1991) (4) Budavari S ed; The Merck Index. 12th ed Whitehouse Station, NJ: Merck and Co., p. 353 (1996) (5) Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]
****PEER REVIEWED****

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 90(SRC), determined from an estimation method(2), indicates that 2-chloroacetophenone is not expected to adsorb to suspended solids and sediment(SRC). Volatilization from water surfaces is expected(3) based upon an estimated Henry's Law constant of 3.5×10^{-6} atm-cu m/mole(SRC), developed using a fragment constant estimation method(4). Using this Henry's Law constant and an estimation method(3), volatilization half-lives for a model river and model lake are 14 and 110 days, respectively(SRC). 2-Chloroacetophenone undergoes hydrolysis, but very slowly; products are hydrochloric acid and hydroacetophenone(8). According to a classification scheme(5), an estimated BCF of 1(SRC), from an estimated log Kow of 1.93(6) and a regression-derived equation(7), suggests the potential for bioconcentration in aquatic organisms is extremely low. Insufficient data are available to predict the importance of biodegradation in water(SRC).

[(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Meylan WM et al; Environ Sci Technol 26: 1560-67 (1992) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 4-9, 15-1 to 15-29 (1990) (4) Meylan WM, Howard PH; Environ Toxicol Chem 10: 1283-93 (1991) (5) Franke C et al; Chemosphere 29: 1501-14 (1994) (6) Howard PH, Meylan WM; Handbook of Physical Properties of Organic Chemicals. Boca Raton, FL: Lewis p. 370 (1997) (7) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999) (8) Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]
****PEER REVIEWED****

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), 2-chloroacetophenone, which has a vapor pressure of 5.4×10^{-3} mm Hg at 25 deg C(2), is expected to exist solely in the vapor-phase in the ambient atmosphere. Vapor-phase 2-chloroacetophenone is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 8 days(SRC), calculated from its estimated rate constant of 1.74×10^{-12} cu cm/molecule-sec at 25 deg C(3). The UV spectrum for a hexane solution of 2-chloroacetophenone shows absorbency maxima occurring at 291 and 329 nm(4) which indicates that 2-chloroacetophenone may directly photolyze in the environment(SRC); the potential importance of direct photolysis is not known because kinetic rate data are not available(SRC).

[(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) Budavari S ed; The Merck Index. 12th ed Whitehouse Station, NJ: Merck and Co., p. 353 (1996) (3) Atkinson R; Environ Sci Technol 21: 1014-22 (1987) (4) Weast RC; Handbook of Chemistry and Physics 60th ed. Boca Raton, FL: CRC Press p. C-99 (1979)]
****PEER REVIEWED****

Environmental Biodegradation:

Inoculation of a sterile solution (containing 6% glucose, 4% peptone, 4% yeast extract, 4% malt extract, and 100 mg 2-chloroacetophenone) with *Cryptococcus macerans* for a 2-day period yielded the corresponding chlorohydrin and 2-chloro-1-phenylethanol(1).

[(1) Imuta M et al; J Org Chem 45: 3352-5 (1980)]
****PEER REVIEWED****

Environmental Abiotic Degradation:

The rate constant for the vapor-phase reaction of 2-chloroacetophenone with photochemically-produced hydroxyl radicals has been estimated as 1.74×10^{-12} cu cm/molecule-sec at 25 deg C(1). This

corresponds to an atmospheric half-life of about 8 days at an atmospheric concentration of 5×10^5 hydroxyl radicals per cu cm(SRC). 2-Chloroacetophenone undergoes hydrolysis, but very slowly; products are hydrochloric acid and hydroacetophenone(2). The UV spectrum for a hexane solution of 2-chloroacetophenone shows absorbency maxima occurring at 291 and 329 nm(3) which indicates that 2-chloroacetophenone may directly photolyze in the environment(SRC); the potential importance of direct photolysis is not known because kinetic rate data are not available(SRC).

[(1) Atkinson R; Environ Sci Technol 21: 1014-22 (1987) (2) Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987) (3) Weast RC; Handbook of Chemistry and Physics 60th ed. Boca Raton, FL: CRC Press p. C-99 (1979)]**PEER REVIEWED**

Environmental Bioconcentration:

An estimated BCF of 1 was calculated for 2-chloroacetophenone(SRC), using an estimated log Kow of 1.93(1) and a regression-derived equation(2). According to a classification scheme(3), this BCF suggests the potential for bioconcentration in aquatic organisms is extremely low.

[(1) Howard PH, Meylan WM; Handbook of Physical Properties of Organic Chemicals. Boca Raton, FL: Lewis p. 370 (1997) (2) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999) (3) Franke C et al; Chemosphere 29: 1501-14 (1994)]**PEER REVIEWED**

Soil Adsorption/Mobility:

Using a structure estimation method based on molecular connectivity indices(1), the Koc for 2-chloroacetophenone can be estimated to be 90(SRC). According to a classification scheme(2), this estimated Koc value suggests that 2-chloroacetophenone is expected to have high mobility in soil.

[(1) Meylan WM et al; Environ Sci Technol 26: 1560-67 (1992) (2) Swann RL et al; Res Rev 85: 17-28 (1983)]**PEER REVIEWED**

Volatilization from Water/Soil:

The Henry's Law constant for 2-chloroacetophenone is estimated as 3.5×10^{-6} atm-cu m/mole(SRC) using a fragment constant estimation method(1). This Henry's Law constant indicates that 2-chloroacetophenone is expected to volatilize from water surfaces(2). Based on this Henry's Law constant, the volatilization half-life from a model river (1 m deep, flowing 1 m/sec, wind velocity of 3 m/sec)(2) is estimated as 14 days(SRC). The volatilization half-life from a model lake (1 m deep, flowing 0.05 m/sec, wind velocity of 0.5 m/sec)(2) is estimated as 110 days(SRC). 2-Chloroacetophenone's Henry's Law constant(1) indicates that volatilization from moist soil surfaces may occur(SRC). 2-Chloroacetophenone is not expected to volatilize from dry soil surfaces(SRC) based upon a vapor pressure of 5.4×10^{-3} mm Hg(3).

[(1) Meylan WM, Howard PH; Environ Toxicol Chem 10: 1283-93 (1991) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990) (3) Budavari S ed; The Merck Index. 12th ed Whitehouse Station, NJ: Merck and Co., p. 353 (1996)]**PEER REVIEWED**

Environmental Standards & Regulations:

TSCA Requirements:

Section 8(a) of TSCA requires manufacturers of this chemical substance to report preliminary assessment information concerned with production, use, and exposure to EPA as cited in the preamble in 51 FR 41329.

[40 CFR 712.30 (7/1/99)]**PEER REVIEWED**

Pursuant to section 8(d) of TSCA, EPA promulgated a model Health and Safety Data Reporting Rule. The section 8(d) model rule requires manufacturers, importers, and processors of listed chemical substances and mixtures to submit to EPA copies and lists of unpublished health and safety studies. 2-Chloroacetophenone is included on this list.

[40 CFR 716.120 (7/1/99)]**PEER REVIEWED**

CERCLA Reportable Quantities:

Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 100 lb or 45.4 kg. The toll free number of the NRC is (800) 424-8802; In the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

[40 CFR 302.4 (7/1/99)]**PEER REVIEWED**

Atmospheric Standards:

Listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. 2-Chloroacetophenone is included on this list.

[Clean Air Act as amended in 1990, Sect. 112 (b) (1) Public Law 101-549 Nov. 15, 1990]**PEER REVIEWED**

Chemical/Physical Properties:

Molecular Formula:

C8-H7-Cl-O

PEER REVIEWED

Molecular Weight:

154.60

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Color/Form:

Crystals from dil alc, carbon tetrachloride, or light petroleum

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Colorless to gray crystalline solid.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

White crystals

[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York,

NY: John Wiley & Sons, Inc. 1997. 251]**PEER REVIEWED**

Odor:

IN VERY LOW CONCIN IN AIR IT HAS AN ODOR RESEMBLING APPLE BLOSSOMS

[Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984.,p. II-96]**PEER REVIEWED**

Sharp, irritating odor.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

Boiling Point:

244-245 deg C

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Melting Point:

58-59 deg C; also reported as 54 deg C (Macy) and 56.5 deg C (Rheinboldt, Perrier)

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Density/Specific Gravity:

1.324 @ 15 deg C

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Heat of Combustion:

-9,340 BTU/LB= -5,190 CAL/G= -217X10+5 JOULES/KG (EST)

[U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5.])**PEER REVIEWED**

Solubilities:

Practically insol in water; freely sol in alcohol, ether and benzene.

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Sol in acetone and carbon disulfide

[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 251]**PEER REVIEWED**

Spectral Properties:

MAX ABSORPTION (HEXANE): 246 NM (LOG E= 3.92); 280 NM (LOG E= 3.00); 291 NM (LOG E= 286); 329 NM (LOG E= 1.83)

[Weast, R.C. (ed.). Handbook of Chemistry and Physics. 60th ed. Boca Raton, Florida: CRC Press Inc., 1979.,p. C-99]**PEER REVIEWED**

IR: 1169 (Coblentz Society Spectral Collection)

[Weast, R.C. and M.J. Astle. CRC Handbook of Data on Organic Compounds. Volumes I and II. Boca Raton, FL: CRC Press Inc. 1985.,p. V1 31]**PEER REVIEWED**

MASS: 507 (National Bureau of Standards EPA-NIH Mass Spectra Data Base, NSRDS-NBS-63)

[Weast, R.C. and M.J. Astle. CRC Handbook of Data on Organic Compounds. Volumes I and II. Boca Raton, FL: CRC Press Inc. 1985.,p. V1 31]**PEER REVIEWED**

Vapor Density:

5.32 (Air= 1)

[Verschuereen, K. Handbook of Environmental Data on Organic Chemicals. 3rd ed. New York, NY: Van Nostrand Reinhold Co., 1996. 450]**PEER REVIEWED**

Vapor Pressure:

5.4X10⁻³ mm Hg @ 20 deg C

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Other Chemical/Physical Properties:

MP: 20 deg C; **BP:** 237 deg C

[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 251]**PEER REVIEWED**

Must be mixed with alcohol or ether to be used as a liquid aerosol. To be used in normal form as a smoke, it must be heated in the presence of a secondary burning agent either mixed in with the powder or burned in close proximity, such as in a thermal grenade.

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Vapor pressure: 0 deg C, 0.0026 mm Hg; 20 deg C, 0.0041 mm Hg; 52 deg C, 0.152 mm Hg.

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Solid density at 20 deg C = 1.318 g/cc; **liquid density at 58 deg C** = 1.187 g/cc

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Decomposes at 248 deg C; flashpoint is very high and does not interfere with use

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Chemical Safety & Handling:

DOT Emergency Guidelines:

Health: TOXIC; inhalation, ingestion, or skin contact with material may cause severe injury or death. Contact with molten substance may cause severe burns to skin and eyes. Avoid any skin contact. Effects of contact or inhalation may be delayed. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-153]**PEER REVIEWED**

Fire or explosion: Combustible material: may burn but does not ignite readily. When heated, vapors may form explosive mixtures with air: indoors, outdoors, and sewers explosion hazards. Some may polymerize (P) explosively when heated or involved in a fire. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. Runoff may pollute waterways. Substance may be transported in a molten form. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-153]**PEER REVIEWED**

Public safety: CALL Emergency Response Telephone Number. ... Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate enclosed areas. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-153]**PEER REVIEWED**

Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Wear chemical protective clothing which is specifically recommended by the manufacturer. Structural firefighters' protective clothing is recommended for fire situations ONLY; it is not effective in spill situations. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-153]**PEER REVIEWED**

Evacuation: ... Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/
 [U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of aHazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of HazardousMaterials Initiatives and Training (DHM-50), Washington, D.C. (1996).,p. G-153]**PEER

REVIEWED**

Fire: Small fires: Dry chemical, CO2 or water spray. Large fires: Dry chemical, CO2, alcohol-resistant foam or water spray. Move containers from fire area if you can do it without risk. Dike fire control water for later disposal; do not scatter the material. Fire involving tanks or car/trailer loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from the ends of tanks. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of a Hazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of Hazardous Materials Initiatives and Training (DHM-50), Washington, D.C. (1996)., p. G-153]**PEER REVIEWED**

Spill or leak: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. DO NOT GET WATER INSIDE CONTAINER. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of a Hazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of Hazardous Materials Initiatives and Training (DHM-50), Washington, D.C. (1996)., p. G-153]**PEER REVIEWED**

First aid: Move victim to fresh air. Call emergency medical care. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. For minor skin contact, avoid spreading material on unaffected skin. Keep victim warm and quiet. Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. /Chloroacetophenone; Chloroacetophenone, liquid; Chloroacetophenone, solid/

[U.S. Department of Transportation. 1996 North American Emergency Response Guidebook. A Guidebook for First Responders During the Initial Phase of a Hazardous Materials/Dangerous Goods Incident. U.S. Department of Transportation (U.S. DOT) Research and Special Programs Administration, Office of Hazardous Materials Initiatives and Training (DHM-50), Washington, D.C. (1996)., p. G-153]**PEER REVIEWED**

Odor Threshold:

0.1 MG/CU M

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values, 4th ed., 1980. Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists, Inc., 1980. 83]**PEER REVIEWED**

Odor low: 0.1020 mg/cu m; Odor high: 0.15 mg/cu m /Alphachloroacetophenone/
 [Ruth JH; Am Ind Hyg Assoc J 47: A-142-51 (1986)]**PEER REVIEWED**

Skin, Eye and Respiratory Irritations:

IRRITATION THRESHOLDS RANGE FROM 0.15-0.4 MG/CU M; LACRIMATION THRESHOLDS FROM 0.3-0.4 MG/CU M

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values, 4th ed., 1980. Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists, Inc., 1980. 83]**PEER REVIEWED**

Irritant to eyes in concentration of 0.3 ppm. ...

[ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1988. 117]**PEER REVIEWED**

... The substance is an irritant to the upper respiratory tract and the skin.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 264]**PEER REVIEWED**

Accidental overexposure of the eyes ... can result in permanent partial opacity (leukoma); under ordinary exposure ... the severe conjunctivitis, corneal haziness, and pain, ... are not permanent.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 265]**PEER REVIEWED**

NFPA Hazard Classification:

Health: 2. 2= Materials that, on intense or continued (but not chronic) exposure, could cause temporary incapacitation or possible residual injury, including those requiring the use of respiratory protective equipment that has an independent air supply. These materials are hazardous to health, but areas may be entered freely if personnel are provided with full-face mask self-contained breathing apparatus that provides complete eye protection.

[Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997.,p. 325-25]**PEER REVIEWED**

Flammability: 1. 1= This degree includes materials that must be preheated before ignition will occur, such as Class IIIB combustible liquids and solids and semi-solids whose flash point exceeds 200 deg F (93.4 deg C), as well as most ordinary combustible materials. Water may cause frothing if it sinks below the surface of the burning liquid and turns to steam. However, a water fog that is gently applied to the surface of the liquid will cause frothing that will extinguish the fire.

[Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997.,p. 325-25]**PEER REVIEWED**

Reactivity: 0. 0= This degree includes materials that are normally stable, even under fire exposure conditions, and that do not react with water. Normal fire fighting procedures may be used.

[Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997.,p. 325-25]**PEER REVIEWED**

Flash Point:

244 deg F (118 deg C) (Closed cup)

[Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire

Protection Association, 1997.,p. 325-25]**PEER REVIEWED**

Hazardous Reactivities & Incompatibilities:

Water, steam, strong oxidizers [Note: Slowly corrodes metals].

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

Combustible when exposed to heat or flame.

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 724]**PEER REVIEWED**

Hazardous Decomposition:

DANGEROUS WHEN HEATED TO DECOMPOSITION IT EMITS TOXIC FUMES OF /HYDROGEN CHLORIDE./

[Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 724]**PEER REVIEWED**

Prior History of Accidents:

DURING THE DERAILMENT OF A TRAIN CARRYING CHLORINE IN CANADA IN 1979, THE GROUND LEVEL CHLORINE WAS CONFINED TO A NARROW RIBBON OR PLUME DOWNWIND OF THE SITE. AMONG OTHERS, 2-CHLOROACETOPHENONE WAS DETECTED IN THE PLUME WHICH RESULTED FROM THE LEAK-RELATED FIRE.

[LANE DA, THOMSON BA; MONITORING A CHLORINE SPILL; PROC INT TECH CONF TOXIC AIR CONTAM: 141-55 (1981)]**PEER REVIEWED**

Immediately Dangerous to Life or Health:

15 mg/cu m

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

Protective Equipment & Clothing:

FULL FACE ORGANIC CANISTER MASK; SELF CONTAINED BREATHING APPARATUS; RUBBER GLOVES; PROTECTIVE CLOTHING.

[U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Manual Two. Washington, DC: U.S. Government Printing Office, Oct., 1978.])**PEER REVIEWED**

Wear appropriate personal protective clothing to prevent skin contact.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Wear appropriate eye protection to prevent eye contact.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Recommendations for respirator selection. Max concn for use: 3 mg/cu m. Respirator Class(es): Any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust and mist filter. Any supplied-air respirator.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Recommendations for respirator selection. Max concn for use: 7.5 mg/cu m. Respirator Class(es): Any supplied-air respirator operated in a continuous flow mode. Eye protection needed. Any powered, air-purifying respirator with organic vapor cartridge(s) in combination with a dust and mist filter. Eye protection needed.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Recommendations for respirator selection. Max concn for use: 15 mg/cu m. Respirator Class(es): Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter. Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having a high-efficiency particulate filter. Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Recommendations for respirator selection. Condition: Emergency or planned entry into unknown concn or IDLH conditions: Respirator Class(es): Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Recommendations for respirator selection. Condition: Escape from suddenly occurring respiratory hazards: Respirator Class(es): Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern and having a high-efficiency particulate filter. Any appropriate escape-type, self-contained breathing apparatus.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Preventive Measures:

Contact lenses should not be worn when working with this chemical.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

The worker should immediately wash the skin when it becomes contaminated.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Work clothing that becomes wet or significantly contaminated should be removed and replaced.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-

140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

Workers whose clothing may have become contaminated should change into uncontaminated clothing before leaving the work premises.

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 61]**PEER REVIEWED**

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place.

PEER REVIEWED

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers. Contaminated clothing should not be taken home at end of shift, but should remain at employee's place of work for cleaning.

PEER REVIEWED

Shipment Methods and Regulations:

No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./

[49 CFR 171.2 (7/1/96)]**PEER REVIEWED**

The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials.

[IATA. Dangerous Goods Regulations. 41st Ed. Montreal, Canada and Geneva, Switzerland: International Air Transport Association, Dangerous Goods Regulations, 2000. 133]**PEER REVIEWED**

The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article.

[IMDG; International Maritime Dangerous Goods Code; International Maritime Organization p.6099 (1988)]**PEER REVIEWED**

Cleanup Methods:

1. VENTILATE AREA OF SPILL. 2. FOR SMALL QUANTITIES, SWEEP ONTO PAPER OR OTHER SUITABLE MATERIAL, PLACE IN AN APPROPRIATE CONTAINER AND BURN IN SAFE PLACE (SUCH AS A FUME HOOD). LARGE QUANTITIES MAY BE RECLAIMED;

HOWEVER, IF THIS IS NOT PRACTICAL, DISSOLVE IN A FLAMMABLE SOLVENT (SUCH AS ALCOHOL) AND ATOMIZE IN A SUITABLE COMBUSTION CHAMBER EQUIPPED WITH AN APPROPRIATE EFFLUENT GAS CLEANING DEVICE.

[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) PublicationNo. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981.]**PEER REVIEWED**

Disposal Methods:

SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices.

PEER REVIEWED

1. BY MAKING PACKAGE OF ALPHA-CHLOROACETOPHENONE IN PAPER OR OTHER FLAMMABLE MATERIAL AND BURNING IN A SUITABLE COMBUSTION CHAMBER EQUIPPED WITH AN APPROPRIATE EFFLUENT GAS CLEANING DEVICE. 2. BY DISSOLVING ALPHA-CHLOROACETOPHENONE IN A FLAMMABLE SOLVENT (SUCH AS ALCOHOL) AND ATOMIZING IN A SUITABLE COMBUSTION CHAMBER EQUIPPED WITH AN APPROPRIATE EFFLUENT GAS CLEANING DEVICE.

[Mackison, F. W., R. S. Stricoff, and L. J. Partridge, Jr. (eds.). NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards. DHHS(NIOSH) PublicationNo. 81-123 (3 VOLS). Washington, DC: U.S. Government Printing Office, Jan. 1981.]**PEER REVIEWED**

Occupational Exposure Standards:

OSHA Standards:

Permissible Exposure Limit: Table Z-1 8-hr Time Weighted Avg: 0.05 ppm (0.3 mg/cu m).

[29 CFR 1910.1000 (7/1/99)]**PEER REVIEWED**

Threshold Limit Values:

8 hr Time Weighted Avg (TWA) 0.05 ppm

[American Conference of Governmental Industrial Hygienists. TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH. 2000. 24]**PEER REVIEWED**

Excursion Limit Recommendation: Excursions in worker exposure levels may exceed three times the TLV-TWA for no more than a total of 30 min during a work day, and under no circumstances should they exceed five times the TLV-TWA, provided that the TLV-TWA is not exceeded.

[American Conference of Governmental Industrial Hygienists. TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH. 2000. 6]**PEER REVIEWED**

A4. A4= Not classifiable as a human carcinogen.

[American Conference of Governmental Industrial Hygienists. TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH. 2000. 24]**PEER REVIEWED**

NIOSH Recommendations:

Recommended Exposure Limit: 10 Hr Time-Weighted Avg: 0.3 mg/cu m (0.05 ppm).

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

Immediately Dangerous to Life or Health:

15 mg/cu m

[NIOSH. NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 97-140. Washington, D.C. U.S. Government Printing Office, 1997. 60]**PEER REVIEWED**

Manufacturing/Use Information:

Major Uses:

For 2-Chloroacetophenone (USEPA/OPP PC Code: 018001) there are 0 labels match. /SRP: Not registered for current use in the U.S./

[U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on 2-Chloroacetophenone (532-27-4). Available from the Database Query page at <http://www.cdpr.ca.gov/docs/epa/epamenu.htm> as of June 14, 2000.]**PEER REVIEWED**

... ALCOHOL DENATURANT (FORMER USE)

[SRI]**PEER REVIEWED**

Pharmaceutical intermediate; riot control gas

[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 251]**PEER REVIEWED**

Obsolete in military use, common in police agency mixtures of tear gas; principal ingredient in the riot agent under the tradename MACE, Methylchloroform chloro ACETophenone

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Because of its strong lacrimating capacity, /it's/ used as a riot-control agent and in personal protective devices.

[American Conference of Governmental Industrial Hygienists, Inc. Documentation of the Threshold Limit Values and Biological Exposure Indices. 6th ed. Volumes I,II, III. Cincinnati, OH: ACGIH, 1991. 264]**PEER REVIEWED**

Methods of Manufacturing:

From chloroacetylchloride, benzene, and aluminum chloride.

[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 251]**PEER REVIEWED**

Prepn: R. Scholl, H. Korten, Ber 34: 1902 (1901); H. Rheinboldt, M. Perrier, J Am Chem Soc 69: 3148 (1947); Schaefer, Sonnenberg, J Org Chem 28: 1128 (1963)

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Prepared by chlorination of acetophenone with selenium oxychloride

[Compton JAF; Military Chemical and Biological Agents. Chemical and Toxicological

Properties. Caldwell, NJ: Telford Press p. 215 (1987)]**PEER REVIEWED**

Acetophenone (alpha chlorination)

[Ashford, R.D. Ashford's Dictionary of Industrial Chemicals. London, England: Wavelength Publications Ltd., 1994. 195]**PEER REVIEWED**

General Manufacturing Information:

A chem warfare agent with lacrimatory properties

[Budavari, S. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 1996. 353]**PEER REVIEWED**

Formulations/Preparations:

CHEMICAL MACE CONSISTS OF A POTENT LACRIMATOR, CHLOROACETOPHENONE (0.9-1.2%) DISSOLVED IN A MIXTURE OF TRICHLOROTRIFLUOROETHANE (70-80%), 1,1,1-TRICHLOROETHANE (5%), & HYDROCARBONS RESEMBLING KEROSENE (APPROX 4%).

[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 884]**PEER REVIEWED**

93% Purity grade

[Kuney, J.H. (ed.). CHEMCYCLOPEDIA 90. Washington, DC: American Chemical Society, 1990. 109]**PEER REVIEWED**

U. S. Imports:

(1977) AT LEAST 4.99X10+6 G

[SRI]**PEER REVIEWED**

(1981) 4.50X10+5 G (PRINCPL CUSTMS DIST)

[SRI]**PEER REVIEWED**

Laboratory Methods:

Analytic Laboratory Methods:

NIOSH Method 291. Analyte: 2-chloroacetophenone. Matrix: Air. Procedure: Gas chromatography/flame ionization detector. Method Evaluation: Method was validated over the range of 0.18 to 0.62 mg/cu m using a 12 liter sample. Method detection limit: 20 ng. Precision (CVt): 0.061. Interferences: None identified.

[U.S. Department of Health, Education Welfare, Public Health Service. Center for Disease Control, National Institute for Occupational Safety Health. NIOSH Manual of Analytical Methods. 2nd ed. Volumes 1-7. Washington, DC: U.S. Government Printing Office, 1977-present., p. 291-1]**PEER REVIEWED**

Sampling Procedures:

NIOSH Method 291. Analyte: 2-chloroacetophenone. Matrix: Air. Procedure: Adsorption on Tenax gas chromatography, thermal desorption. Flow Rate: 0.01- 0.2 l/min. Sample Size: 12 liters.

[U.S. Department of Health, Education Welfare, Public Health Service. Center for Disease Control, National Institute for Occupational Safety Health. NIOSH Manual of Analytical Methods. 2nd ed. Volumes 1-7. Washington, DC: U.S. Government Printing

Office, 1977-present.,p. 291-1]**PEER REVIEWED**

Special References:

Special Reports:

SCHREMPF A; CHEMICAL MACE- HOW DANGEROUS IS CHLOROACETOPHENONE?; CHEM UNSERER ZEIT 12 (5): 146 (1978). A REVIEW, WITH 59 REFERENCES, OF THE TOXICOLOGY AND CHEMISTRY OF THE LACRIMATOR MACE.

Hu H et al; J Am Med Assoc 262 (5): 660-663 (1989). The uses of tear gas, its toxicity, and treatment for exposure were reviewed. The two compounds most commonly used in recent years were identified as omega-chloroacetophenone and o-chlorobenzylidenemalononitrile. Previous reports and reviews of tear gas usage and exposure effects were considered.

Danto BL; Medical Problems and Criteria Regarding Use of Tear Gas by Police; Am J Forensic Med Pathol 8 (4): 317-22 (1987). This paper addresses the basic types of gas in terms of their chemistry, uses, and medical side effects and complications. Two types of gases namely, chloroacetophenone (CN) and orthochlorobenzylidenemalonitrile (CS) are discussed in terms of basic properties, unique advantages, and possible harm to the body.

DHHS/NTP; Toxicology & Carcinogenesis Studies of 2-Chloroacetophenone in F344/N Rats and B6C3F1 Mice (Inhalation Studies) Technical Report Series No. 379 (1990) NIH Publication No. 90-2834

Synonyms and Identifiers:

Synonyms:

ACETOPHENONE, 2-CHLORO-
PEER REVIEWED

CAF
PEER REVIEWED

CAP
PEER REVIEWED

Chemical Mace
PEER REVIEWED

Chloroacetophenone
PEER REVIEWED

ALPHA-CHLOROACETOPHENONE
PEER REVIEWED

OMEGA-CHLOROACETOPHENONE
PEER REVIEWED

1-CHLOROACETOPHENONE

****PEER REVIEWED****

CHLOROMETHYL PHENYL KETONE

****PEER REVIEWED****

2-Chloro-1-phenylethanone

****PEER REVIEWED****

CN

****PEER REVIEWED****

ETHANONE, 2-CHLORO-1-PHENYL-

****PEER REVIEWED****

MACE

****PEER REVIEWED****

MACE (LACRIMATOR)

****PEER REVIEWED****

NCI-C55107

****PEER REVIEWED****

Phenacylchloride

****PEER REVIEWED****

PHENYLCHLOROMETHYLKETONE

****PEER REVIEWED****

"Tear gas"

****PEER REVIEWED****

Formulations/Preparations:

CHEMICAL MACE CONSISTS OF A POTENT LACRIMATOR, CHLOROACETOPHENONE (0.9-1.2%) DISSOLVED IN A MIXTURE OF TRICHLOROTRIFLUOROETHANE (70-80%), 1,1,1-TRICHLOROETHANE (5%), & HYDROCARBONS RESEMBLING KEROSENE (APPROX 4%).
[Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986. 884] ****PEER REVIEWED****

93% Purity grade

[Kuney, J.H. (ed.). CHEMCYCLOPEDIA 90. Washington, DC: American Chemical Society, 1990. 109] ****PEER REVIEWED****

Shipping Name/ Number DOT/UN/NA/IMO:

UN 1697; Chloroacetophenone liquid or solid.

IMO 6.1; Chloroacetophenone liquid or solid

RTECS Number:

NIOSH/AM6300000

Administrative Information:

Hazardous Substances Databank Number: 972

Last Revision Date: 20010426

Last Review Date: Reviewed by SRP on 9/14/2000

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Complete Update on 03/18/1998, 3 fields added/edited/deleted.
Field Update on 10/20/1997, 1 field added/edited/deleted.
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Complete Update on 01/19/1996, 1 field added/edited/deleted.
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Complete Update on 12/22/1994, 1 field added/edited/deleted.
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Field Update on 07/19/1994, 1 field added/edited/deleted.
Field Update on 03/21/1994, 1 field added/edited/deleted.
Field Update on 08/30/1993, 1 field added/edited/deleted.
Field Update on 08/03/1993, 1 field added/edited/deleted.
Field update on 12/17/1992, 1 field added/edited/deleted.
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Field Update on 09/04/1992, 1 field added/edited/deleted.
Field Update on 09/04/1992, 1 field added/edited/deleted.
Complete Update on 08/17/1992, 59 fields added/edited/deleted.
Field Update on 04/16/1992, 1 field added/edited/deleted.
Field Update on 01/13/1992, 1 field added/edited/deleted.
Field Update on 09/10/1991, 1 field added/edited/deleted.
Complete Update on 01/07/1991, 12 fields added/edited/deleted.
Field Update on 01/15/1990, 1 field added/edited/deleted.
Complete Update on 01/11/1990, 8 fields added/edited/deleted.
Field Update on 07/06/1988, 1 fields added/edited/deleted.
Field Update on 07/06/1988, 1 fields added/edited/deleted.
Complete Update on 03/01/1985

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